

*Journal of Chemical Ecology* is devoted to promoting an understanding of the origin, function, and significance of natural chemicals that mediate interactions within and between organisms. Such relationships, often adaptively important, comprise the oldest of communication systems in terrestrial and aquatic environments. With recent advances in methodology for elucidating structures of the chemical compounds involved, a strong interdisciplinary association has developed between chemists and biologists which should accelerate understanding of these interactions in nature.

Scientific contributions are welcome from either members or nonmembers of the International Society of Chemical Ecology. Manuscripts must be in English and may include original research and reviews in both the biological and chemical phases of chemical ecology. They may include substantive observations of interactions in nature, the elucidation of the chemical compounds involved, the mechanisms of their production and reception, and the translation of such basic information into survey and control protocols. Sufficient biological and chemical detail should be given to substantiate conclusions and to permit results to be evaluated and reproduced.

Letters to the Editor provide an opportunity for opinion, discussion, and rebuttal.

## EDITORS

**Robert M. Silverstein**  
Department of Chemistry  
College of Environmental Science and Forestry  
State University of New York  
Syracuse, New York

**John B. Simeone**  
Department of Environmental and Forest Biology  
College of Environmental Science and Forestry  
State University of New York  
Syracuse, New York

## EDITORIAL BOARD

**Thomas C. Baker**, University of California, Riverside, California  
**John E. Bardach**, East-West Center, Honolulu, Hawaii  
**Gunnar Bergström**, University of Göteborg, Göteborg, Sweden  
**Elizabeth A. Bernays**, University of California, Berkeley  
**Martin C. Birch**, Oxford University, Oxford, England  
**Murray S. Blum**, The University of Georgia, Athens, Georgia  
**John H. Borden**, Simon Fraser University, Burnaby, B. C., Canada  
**William S. Bowers**, New York State Agricultural Experiment Station, Geneva, New York  
**F. H. Bronson**, The University of Texas, Austin, Texas  
**Lincoln P. Brower**, University of Florida, Gainesville, Florida  
**Gordon M. Burghardt**, University of Tennessee, Knoxville, Tennessee  
**Wendell E. Burkholder**, University of Wisconsin, Madison, Wisconsin  
**Ring T. Cardé**, University of Massachusetts, Amherst, Massachusetts  
**Thomas Eisner**, Cornell University, Ithaca, New York  
**Bert Hölldobler**, Harvard University, Cambridge, Massachusetts  
**John S. Kennedy**, Oxford University, Oxford, United Kingdom  
**Waldemar Klassen**, Plant and Entomological Sciences USDA-SEA, Beltsville, Maryland  
**Gerald N. Lanier**, State University of New York College of Environmental Science and Forestry, Syracuse, New York  
**Thomas J. Mabry**, University of Texas, Austin, Texas  
**Jerrold Meinwald**, Cornell University, Ithaca, New York  
**C. H. Muller**, University of California, Santa Barbara, California  
**Dietland Müller-Schwarze**, State University of New York College of Environmental Science and Forestry, Syracuse, New York  
**Roman Mykutowycz**, CSIRO, Canberra, Australia  
**Koji Nakanishi**, Columbia University, New York, New York  
**Glenn D. Prestwich**, State University of New York, Stony Brook, New York  
**Elroy L. Rice**, The University of Oklahoma, Norman, Oklahoma  
**F. J. Ritter**, Institute of Applied Chemistry TNO, Zeist, The Netherlands  
**Wendell L. Roelofs**, New York State Agricultural Experiment Station, Geneva, New York  
**Dietrich Schneider**, Max-Planck-Institut für Verhaltensphysiologie, Seewiesen, Republic of Germany  
**James H. Tumlinson**, USDA-ARS-SR, Insect Attractants and Basic Biology Laboratory, Gainesville, Florida  
**S. B. Vinson**, Texas A&M University, College Station, Texas  
**Iain Weatherston**, Laval University, Quebec City, Canada  
**David L. Wood**, University of California, Berkeley, California

*Journal of Chemical Ecology* is published monthly by Plenum Publishing Corporation, 233 Spring Street, New York, N.Y. 10013. Subscription orders should be addressed to the publisher. *Journal of Chemical Ecology* is abstracted or indexed in Biological Abstracts, Chemical Abstracts, Current Contents, Energy Research Abstracts, Field Crop Abstracts, Herbage Abstracts, Referativnyi Zhurnal, and Wildlife Research. © 1986 Plenum Publishing Corporation. *Journal of Chemical Ecology* participates in the Copyright Clearance Center (CCC) Transactional Reporting Service. The appearance of a code line at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use. However, this consent is given on the condition that the copier pay the flat fee of \$5.00 per copy per article (no additional per-page fees) directly to the Copyright Clearance Center, Inc., 27 Congress Street, Salem, Massachusetts 01970, for all copying not explicitly permitted by Sections 107 or 108 of the U.S. Copyright Law. The CCC is a nonprofit clearinghouse for the payment of photocopying fees by libraries and other users registered with the CCC. Therefore, this consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, nor to the reprinting of figures, tables, and text excerpts. 0098-0331/86 \$5.00

## Subscription rates:

Volume 12, 1986 (12 issues) \$250.00 (outside the U.S., \$281.00). Price for individual subscribers certifying that the journal is for their personal use, \$65.00 (outside the U.S., \$78.00).

Volume 13, 1987 (12 issues) \$275.00 (outside the U.S., \$309.00). Price for individual subscribers certifying that the journal is for their personal use, \$65.00 (outside the U.S., \$78.00).

Second-class postage paid at New York, N.Y., and at additional mailing offices. Postmaster: Send address changes to *Journal of Chemical Ecology*, Plenum Publishing Corporation, 233 Spring Street, New York, N.Y. 10013.

*Journal of Chemical Ecology* is published monthly by Plenum Publishing Corporation, 233 Spring Street, New York, N.Y. 10013. Subscription orders should be addressed to the publisher. *Journal of Chemical Ecology* is abstracted or indexed in Biological Abstracts, Chemical Abstracts, Current Contents, Energy Research Abstracts, Field Crop Abstracts, Herbage Abstracts, Referativnyi Zhurnal, and Wildlife Research. © 1986 Plenum Publishing Corporation. *Journal of Chemical Ecology* participates in the Copyright Clearance Center (CCC) Transactional Reporting Service. The appearance of a code line at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use. However, this consent is given on the condition that the copier pay the flat fee of \$5.00 per copy per article (no additional per-page fees) directly to the Copyright Clearance Center, Inc., 27 Congress Street, Salem, Massachusetts 01970, for all copying not explicitly permitted by Sections 107 or 108 of the U.S. Copyright Law. The CCC is a nonprofit clearinghouse for the payment of photocopying fees by libraries and other users registered with the CCC. Therefore, this consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, nor to the reprinting of figures, tables, and text excerpts. 0098-0331/86 \$5.00



# Journal of Chemical Ecology

Volume 12, Number 1

January 1986

## CONTENTS

- Components of Female Sex Pheromone of Cocoa Pod Borer Moth, *Conopomorpha cramerella* 1  
P.S. BEEVOR, A. CORK, D.R. HALL, BRENDA F. NESBITT, R.K. DAY, and J.D. MUMFORD
- Sensory and Behavioral Effects of Gossypure Alcohol on Sex Pheromone Response of Male Pink Bollworm Moths, *Pectinophora gossypiella* 25  
W. LI, K.F. HAYNES, and T.C. BAKER
- Behavioral Responses of Male and Female Mexican Fruit Flies, *Anastrepha ludens*, to Male-Produced Chemicals in Laboratory Experiments 39  
D.C. ROBACKER and W.G. HART
- Flavonoid Pigments and Wing Color in *Melanargia galathea* 49  
ANGELA WILSON
- 2,6-Dichlorophenol in the Tick *Rhipicephalus appendiculatus* Neumann: A Reappraisal 69  
P.G. McDOWELL and S.M. WALADDE
- Inhibitory Action of (4*S*,6*S*,7*R*)-Isomer to Pheromonal Activity of Serricornin, (4*S*,6*S*,7*S*)-7-Hydroxy-4,6-Dimethyl-3-Nonanone 83  
M. MORI, K. MOCHIZUKI, M. KOHNO, T. CHUMAN, A. OHNISHI, H. WATANABE, and K. MORI
- Orientation of Boll Weevil, *Anthonomus grandis* Boh. (Coleoptera: Curculionidae), to Pheromone and Volatile Host Compound in the Laboratory 91  
JOSEPH C. DICKENS
- Urinary Signaling Pheromone and Specific Behavioral Response in Tree Shrews (*Tupaia belangeri*): I. Basic Investigations for a Bioassay 99  
F.V. STRALENDORFF
- Chemical and Behavioral Analyses of Volatile Sex Pheromone Components Released by Calling *Heliothis virescens* (F.) Females (Lepidoptera: Noctuidae) 107  
P.E.A. TEAL, J.H. TUMLINSON, and R.R. HEATH
- Synthesis of Diastereomeric Mixture of 15,19,23-Trimethylheptatriacontane, Contact Sex Pheromone of Tsetse Fly, *Glossina morsitans morsitans* Westwood 127  
YOSHINOBU NAOSHIMA, HIROSHI MUKAIDANI, SHOHEI SHIBAYAMA, and TOSHIYA MURATA
- Chemical Identification and Behavioral Characterization of Male Wing Pheromone of *Ephestia elutella* (Pyralidae) 135  
P.L. PHELAN, P.J. SILK, C.J. NORTHCOTT, S.H. TAN, and T.C. BAKER
- Effect of Combined Feeding Stimuli on Ingestion by the Nematode *Trichostrongylus colubriformis* 147  
KURT P. BOTTJER and LEON W. BONE
- Chemical Fractionation of Shrimp Extracts Inducing Bottom Food Search Behavior in Cod (*Gadus morhua* L.) 155  
O.F. ELLINGSEN and K.B. DØVING

Fate of Ingested Iridoid Glycosides in Lepidopteran Herbivores M. DEANE BOWERS and GILLIAN M. PUTTICK	169
Reinvestigation of Anhydroserricornin, (2 <i>S</i> ,3 <i>S</i> )-2,6-Diethyl-3,5-Dimethyl-3,4-Dihydro-2 <i>H</i> -Pyran, as a Sex Pheromone Component for Male Cigarette Beetle K. MOCHIZUKI, M. MORI, T. CHUMAN, M. KOHNO, A. OHNISHI, H. WATANABE, and K. MORI	179
Volatile Fatty Acids in Urine and Vaginal Secretions of Cows During Reproductive Cycle PETR HRADECKÝ	187
Species, Individual and Kin Specific Blends in Dufour's Gland Secretions of Halictine Bees: Chemical Evidence ABRAHAM HEFETZ, GUNNAR BERGSTRÖM, and JAN TENGÖ	197
Allelopathic Suppression of Weed and Nitrification by Selected Cultivars of <i>Sorghum bicolor</i> (L.) Moench IBRAHIM S. ALSAADAWI, JAWAD K. AL-UQAILI, AHLAM J. ALRUBEAA, and SATTA M. AL-HADITHY	209
Effects of Three Phenolic Acids on Chlorophyll Content and Ions Uptake in Cowpea Seedlings IBRAHIM S. ALSAADAWI, SATTA M. AL-HADITHY, and MAHMOUD B. ARIF	221
Female Sex Pheromone of the Melonworm, <i>Diaphania hyalinata</i> (Lepidoptera: Pyralidae), and Analysis of Male Responses to Pheromone in a Flight Tunnel A.K. RAINA, J.A. KLUN, M. SCHWARZ, A. DAY, B.A. LEONHARDT, and L.W. DOUGLASS	229
Female Sex Pheromone of the Pickleworm, <i>Diaphania nitidalis</i> (Lepidoptera: Pyralidae) J.A. KLUN, B.A. LEONHARDT, M. SCHWARZ, A. DAY, and A.K. RAINA	239
Synthesis of Pungenin, a Foliar Constituent of Some Spruce Species, and Investigation of Its Efficacy as a Feeding Deterrent for Spruce Budworm [ <i>Choristoneura fumiferana</i> (Clem.)] GEORGE M. STRUNZ, PIERRE GIGUÈRE, and ANTHONY W. THOMAS	251
Chemical Attractants Tested Against the Australian Bush Fly <i>Musca vetustissima</i> (Diptera: Muscidae) MIR S. MULLA and JAMES T. RIDSDILL-SMITH	261
Chemical Detection of "Self" and Conspecifics by Crayfish R.D. ROSE	271
Urinary Volatile Constituents of the House Mouse, <i>Mus musculus</i> , and Their Endocrine Dependency F.J. SCHWENDE, D. WIESLER, J.W. JORGENSEN, M. CARMACK, and M. NOVOTNY	277
Chemical Scent Constituents in Urine of Wolf ( <i>Canis lupus</i> ) and Their Dependence on Reproductive Hormones J. RAYMER, D. WIESLER, M. NOVOTNY, C. ASA, U.S. SEAL, and L.D. MECH	297
BOOK REVIEW	
<i>Techniques in Pheromone Research</i> , Edited by Hans E. Hummel and Thomas A. Miller REVIEWED BY FRIDO J. RITTER	315



## CONTENTS

### Special Issue: Symposium on Bioorganic Chemistry of Communication Systems

Bioorganic Chemistry of Communication Systems GLENN D. PRESTWICH	319
Binding and Hydrolysis of Radiolabeled Pheromone and Several Analogs by Male-Specific Antennal Proteins of the Moth <i>Antheraea polyphemus</i> GLENN D. PRESTWICH, RICHARD G. VOGT, AND LYNN M. RIDDIFORD	323
Pheromone Biosynthesis and Role of Functional Groups in Pheromone Specificity DAVID MORSE AND EDWARD MEIGHEN	335
Terminal Steps in Pheromone Biosynthesis by <i>Heliothis virescens</i> and <i>H. zea</i> P. E. A. TEAL AND J. H. TUMLINSON	353
Spruce Budworm ( <i>Choristoneura fumiferana</i> ) Pheromone Chemistry and Behavioral Responses to Pheromone Components and Analogs PETER J. SILK AND L. P. S. KUENEN	367
Pheromones of Two Arctiid Moths ( <i>Cretonotos transiens</i> and <i>C. gangis</i> ): Chiral Components from Both Sexes and Achiral Female Components THOMAS W. BELL AND JERROLD MEINWALD	385
Metabolic Transformations of Tritium-Labeled Pheromone by Tissues of <i>Heliothis virescens</i> Moths YU-SHIN DING AND GLENN D. PRESTWICH	411
Sex Pheromone Biosynthesis in the Red-Banded Leafroller Moth, Studied by Mass-Labeling with Stable Isotopes and Analysis with Mass Spectrometry LOUIS B. BJOSTAD AND WENDELL L. ROELOFS	431
Insect Olfactory Receptor Responses to Components of Pheromone Blends ROBERT J. O'CONNELL, JEFFREY T. BEAUCHAMP, AND ALAN J. GRANT	451
Scale Esterase: A Pheromone-Degrading Enzyme from Scales of Silk Moth <i>Antheraea polyphemus</i> RICHARD G. VOGT AND LYNN M. RIDDIFORD	469
Metabolism of Pheromone Components and Analogs by Cuticular Enzymes of <i>Choristoneura fumiferana</i> GREG C. LONERGAN	483
Reproductive Endocrine Influences upon Olfactory Perception: A Current Perspective RICHARD L. DOTY	497
Analysis of Chemical Signals in a Primate Species ( <i>Saguinus fuscicollis</i> ): Use of Behavioral, Chemical, and Pattern Recognition Methods A. M. BELCHER, A. B. SMITH, III, P. C. JURs, B. LAVINE, AND G. EPPL	513
Enzymatic Adaptations of Herbivorous Insects and Mites to Phytochemicals SAMI AHMAD	533
The Haustorium and the Chemistry of Host Recognition in Parasitic Angiosperms MAYLAND CHANG AND DAVID G. LYNN	561
ANNOUNCEMENT	581

## CONTENTS

Components of Moribund American Elm Trees as Attractants to Elm Bark Beetles, <i>Hylurgopinus rufipes</i> and <i>Scolytus multistriatus</i>	583
JOCELYN G. MILLAR, CHENG-HUA ZHAO, GERALD N. LANIER, DEALGA P. O'CALLAGHAN, MICHAEL GRIGGS, JANET R. WEST, and ROBERT M. SILVERSTEIN	
Cross-Attraction Between Two Species of <i>Matsucoccus</i> : Extraction Bioassay, and Isolation of the Sex Pheromone	609
S.C. PARK, J.R. WEST, L.P. ABRAHAMSON, G.N. LANIER, and R.M. SILVERSTEIN	
Stereoselective Synthesis of (Z, E)-3,5-Tetradecadienyl Acetate: Sex Attractant for Carpenterworm Moth, <i>Prionoxystus robiniae</i> (Peck) (Lepidoptera: Cossidae) and Effect of Isomers and Monounsaturated Acetates on Its Attractiveness	619
R.E. DOOLITTLE and J.D. SOLOMON	
Detoxification Function of Geophagy and Domestication of the Potato	635
TIMOTHY JOHNS	
Isolation of Feeding Deterrents Against Argentine Stem Weevil from Ryegrass Infected with the Endophyte <i>Acremonium loliae</i>	647
D.D. ROWAN and D.L. GAYNOR	
Male Moth Sensitivity to Multicomponent Pheromones: Critical Role of Female-Released Blend in Determining the Functional Role of Components and Active Space of the Pheromone	659
C.E. LINN, JR., M.G. CAMPBELL, and W.L. ROELOFS	
Contents of Dufour Glands of Workers of Three Species of <i>Tetramorium</i> (Hymenoptera: Formicidae)	669
J.P.J. BILLEN, R.P. EVERSHERD, A.B. ATTYGALLE, E.D. MORGAN, and D.G. OLLETT	
Identification of a Volatile Attractant for <i>Diabrotica</i> and <i>Acalymma</i> Spp. from Blossoms of <i>Cucurbita maxima</i> Duchesne	687
J.F. ANDERSEN and R.L. METCALF	
Soldier Defense Secretions of the Genus <i>Hospitalitermes</i> in Peninsular Malaysia	701
C.H. CHUAH, S.H. GOH, and Y.P. THO	
<i>Lespedeza</i> Phenolics and <i>Penstemon</i> Alkaloids: Effects on Digestion Efficiencies and Growth of Voles	713
RICHARD L. LINDROTH, GEORGE O. BATZLI, and SUSAN I. AVILDSSEN	
Feeding Responses of Snowshoe Hares ( <i>Lepus americanus</i> ) to Volatile Constituents of Red Fox ( <i>Vulpes vulpes</i> ) Urine	729
THOMAS P. SULLIVAN and DOUGLAS R. CRUMP	
Identification of Cantharidin in False Blister Beetles (Coleoptera, Oedemeridae) from Florida	741
JAMES E. CARREL, JAMES P. DOOM, and JOHN P. MCCORMICK	
Idiosyncratic Variation in Chemical Defenses Among Individual Generalist Grasshoppers	749
CLIVE G. JONES, TIMOTHY A. HESS, DOUGLAS W. WHITMAN, PETER J. SILK, and MURRAY S. BLUM	

Sex Pheromone of <i>Adoxophyes orana</i> : Additional Components and Variability in Ratio of (Z)-9- and (Z)-11-Tetradecenyl Acetate P.M. GUERIN, H. ARN, H.R. BUSER, and P.J. CHARMILLOT	763
Chemical Mate Recognition and Release of Male Sexual Behavior in Polybiine Wasp, <i>Belonogaster petiolata</i> (Degeer) (Hymenoptera: Vespidae) M.G. KEEPING, D. LIPSCHITZ, and R.M. CREWE	773
Selective Olfactory Choices of the Honeybee Among Sunflower Aromas: Study by Combined Olfactory Conditioning and Chemical Analysis M.H. PHAN-DELEGUE, C. MASSON, P. ETIEVANT, M. AZAR	781
Role of Secondary Metabolites in Feeding Associations Between a Predatory Nudibranch, Two Grazing Nudibranchs, and a Bryozoan BRAD CARTÉ and D. JOHN FAULKNER	795
BOOK REVIEW Semiochemistry: Flavors and Pheromones E. DAVID MORGAN	805

---



## CONTENTS

EDITORS' NOTE	807
INTRODUCTION	809
MAY R. BERENBAUM	
Significance of Phototoxic Phytochemicals in Insect Herbivory	813
G.H.N. TOWERS	
Toxicological Action and Ecological Importance of Plant Photosensitizers	823
K.R. DOWNUM and E. RODRIGUEZ	
Light-Mediated Allelochemical Effects of Naturally Occurring Polyacetylenes and Thiophenes from Asteraceae on Herbivorous Insects	835
D.E. CHAMPAGNE, J.T. ARNASON, B.J.R. PHILOGÈNE, P. MORAND, and J. LAM	
Insect Defenses Against Phototoxic Plant Chemicals	859
RICHARD A. LARSON	
Comparative Metabolism of [ <sup>3</sup> H] Psoralen and [ <sup>3</sup> H] Isopsoralen by Black Swallowtail ( <i>Papilio polyxenes</i> Fabr.) Caterpillars	871
G. WAYNE IVIE, DON L. BULL, ROSS C. BEIER, and NAN W. PRYOR	
In Vitro Metabolism of a Linear Furanocoumarin (8-Methoxypsoralen, Xanthotoxin) by Mixed-Function Oxidases of Larvae of Black Swallowtail Butterfly and Fall Armyworm	885
DON L. BULL, G. WAYNE IVIE, ROSS C. BEIER, and NAN W. PRYOR	
Efficacy of the Plant Phototoxin $\alpha$ -Terthienyl Against <i>Aedes intrudens</i> and Effects on Nontarget Organisms	893
B.J.R. PHILOGÈNE, J.T. ARNASON, C.W. BERG, F. DUVAL, and P. MORAND	
Delayed Phototoxic Effects of 8-Methoxypsoralen, Khellin, and Sphondin in <i>Aedes aegypti</i>	899
JACQUES KAGAN, PATRICIA SZCZEPANSKI, VYTAUTAS BINDOKAS, WILLIAM D. WULFF, and J. STUART MCCALLUM	
Detection of Furocoumarins in Plants and Plant Products with an Ultrasensitive Biological Photoassay Employing a DNA-Repair-Deficient Bacterium	915
M.J. ASHWOOD-SMITH, O. CESKA, S.K. CHAUDHARY, P.J. WARRINGTON, and P. WOODCOCK	
Inactivation and Mutagenesis by Phototoxins Using <i>Escherichia coli</i> Strains Differing in Sensitivity to Near- and Far-Ultraviolet Light	933
R.W. TUVESON, MAY R. BERENBAUM, and ELLEN E. HEININGER	

---



## CONTENTS

EDITORS' NOTE	949
Chemical Ecology of Marine Organisms: An Overview GERALD J. BAKUS, NANCY M. TARGETT, and BRUCE SCHULTE	951
Chemically Stimulated Feeding Behavior in Marine Animals: Importance of Chemical Mixtures and Involvement of Mixture Interactions WILLIAM E. S. CARR and CHARLES D. DERBY	989
Macromolecular Cues in Marine Systems DAN RITTSCHOF and JOSEPH BONAVENTURA	1013
Plant and Fungal Cell Wall Fragments Activate Expression of Proteinase Inhibitor Genes for Plant Defense CLARENCE A. RYAN, PAUL D. BISHOP, JOHN S. GRAHAM, ROXANNE M. BROADWAY, and SEAN S. DUFFEY	1025
Coadaptation of <i>Drosophila</i> and Yeasts in Their Natural Habitat WILLIAM T. STARMER and JAMES C. FOGLEMAN	1037
Cellulose Digestion in <i>Monochamus marmorator</i> Kby. (Coleoptera: Cerambycidae): Role of Acquired Fungal Enzymes JEROME J. KUKOR and MICHAEL M. MARTIN	1057
Behavioral Responses to Chemical Cues by Bacteria DOUGLAS H. BARTLETT and PHILIP MATSUMURA	1071
Chemically Mediated Behavior in Acari: Adaptations for Finding Hosts and Mates DANIEL E. SONENSHINE, DEMAR TAYLOR, and KEITH A. CARSON	1091
Coevolutionary Adaptations of Rootworm Beetles (Coleoptera: Chrysomelidae) to Cucurbitacins ROBERT L. METCALF	1109
Phytochemical Basis of Learning in <i>Rhagoletis pomonella</i> and Other Herbivorous Insects DANIEL R. PAPAJ and RONALD J. PROKOPY	1125
Biochemical Insight into Insecticidal Properties <i>L</i> -Canavanine, a Higher Plant Protective Allelochemical GERALD A. ROSENTHAL	1145
Cardenolide Connection Between Overwintering Monarch Butterflies from Mexico and Their Larval Food Plant, <i>Asclepias syriaca</i> J.N. SEIBER, L.P. BROWER, S.M. LEE, M.M. MCCHESENEY, H.T.A. CHEUNG, C.J. NELSON, and T.R. WATSON	1157
Sequestration of Cardenolides in <i>Oncopeltus fasciatus</i> : Morphological and Physiological Adaptations G.G.E. SCUDDER, L.V. MOORE, and M.B. ISMAN	1171
Economics of Chemical Defense in Chrysomelinae M. ROWELL-RAHIER and J.M. PASTEELS	1189

# Journal of Chemical Ecology

Volume 12, Number 6

June 1986

## CONTENTS

- Allelopathic Polyacetylenes from *Centaurea repens* (Russian Knapweed) 1205  
KENNETH L. STEVENS
- Cuticular Hydrocarbons of Gregarious and Solitary Locusts: *Locusta migratoria cinerascens* 1213  
E. GENIN, R. JULLIEN, F. PEREZ, and S. FUZEAU-BRAESCH
- Western Avocado Leafroller, *Amorbia cuneana* (Walsingham), (Lepidoptera: Tortricidae): Discovery of Populations Utilizing Different Ratios of Sex Pheromone Components 1239  
J.B. BAILEY, L.M. McDONOUGH, and M.P. HOFFMAN
- Beneficial Arthropod Behavior Mediated by Airborne Semiochemicals I. Flight Behavior and Influence of Preflight Handling of *Microplitis croceipes* (Cresson) 1247  
Y.C. DROST, W.J. LEWIS, P.O. ZANEN, and M.A. KELLER
- Studies on the Identification and Syntheses of Insect Pheromones XXII. Sex Pheromone of the Poplar Twig Clearwing Moth *Paranthrene tabaniformis* Rott—*Structure and Synthesis* 1263  
ZHANG XUE-HAI, GUO GUANG-ZHONG, LIN QUO-QIANG, WU YUAN-WEI, WU PEI-HENG, LI ZHEN-YU, and WEI KANG NIAN
- Field Studies on Chemically Mediated Behavior in a Land Hermit Crab: Volatile and Nonvolatile Odors 1273  
DAN RITTSCHOF and JOHN P. SUTHERLAND
- Propaganda Substances in the Cuckoo Ant *Leptothorax kutteri* and the Slave-maker *Harpagoxenus sublaevis* 1285  
ANTHONY B. ALLIES, ANDREW F.G. BOURKE, and NIGEL R. FRANKS
- Predator Deterrence by Mandibular Gland Secretions of Bees (Hymenoptera: Apoidea) 1295  
JAMES H. CANE
- BOOK REVIEW  
*Insect Communication* edited by Trevor Lewis 1311  
REVIEWED BY CHARLES E. LINN JR.
- Plant Allelochemicals and Insect Parasitoids: Effects of Nicotine on *Cotesia congregata* (Say) (Hymenoptera: Braconidae) and *Hyposoter annulipes* (Cresson) (Hymenoptera: Ichneumonidae) 1319  
P. BARBOSA, J.A. SAUNDERS, J. KEMPER, R. TRUMBULE, J. OLECHNO, and P. MARTINAT
- Effects of Consumption of High and Low Nicotine Tobacco by *Manduca sexta* (Lepidoptera: Sphingidae) on Survival of Gregarious Endoparasitoid *Cotesia congregata* (Hymenoptera: Braconidae) 1329  
K.W. THORPE and P. BARBOSA

Laser Microbeam Studies of Role of Amphid Receptors in Chemosensory Behavior of Nematode <i>Caenorhabditis elegans</i>	1339
BOWMAN O. DAVIS, JR., MARIAN GOODE, and DAVID B. DUSENBERY	
Effects of Cuticular Duvane Diterpenes from Green Tobacco Leaves on Tobacco Budworm (Lepidoptera: Noctuidae) Oviposition	1349
D. MICHAEL JACKSON, R.F. SEVERSON, A.W. JOHNSON, and G.A. HERZOG	
Sex Pheromone of <i>Grapholita funebrana</i> : Occurrence of Z-8- and Z-10- Tetradecenyl Acetate as Secondary Components	1361
P.M. GUERIN, H. ARN, H.R. BUSER, P. CHARMILLOT, M. TOTH, and G. SZIRÁKI	
Aggregation of Larvae of <i>Blatella germanica</i> (L.) by Lactic Acid Present in Excreta	1369
J.E. MCFARLANE and I. ALLI	
Female Sex Pheromone of Sugarcane Stalk Borer, <i>Chilo auricilius</i> : Identification of Four Components and Field Tests	1377
BRENDA F. NESBITT, P.S. BEEVOR, A. CORK, D.R. HALL, H. DAVID, and V. NANDAGOPAL	
Vitamin A Deficiency Modifies Response of Predatory Mite <i>Amblyseius potentillae</i> to Volatile Kairomone of Two-Spotted Spider Mite, <i>Tetranychus urticae</i>	1389
MARCEL DICKE, MAURICE W. SABELIUS, and ADRIE GROENEVELD	
Defensive Mechanisms of Loblolly and Shortleaf Pine Against Attack by Southern Pine Beetle, <i>Dendroctonus frontalis</i> Zimmerman, and its Fungal Associate, <i>Ceratocystis minor</i> (Hedgecock) Hunt	1397
STEPHEN P. COOK and FRED P. HAIN	
Necrodols: Anti-Insectan Terpenes from Defensive Secretion of Carrion Beetle (Necrodoes surinamensis)	1407
THOMAS EISNER, MARK DEYRUP, ROBERT JACOBS, and JERROLD MEINWALD	
Sex Pheromone of <i>Eupoecilia ambiguella</i> : Female Analysis and Male Response to Ternary Blend	1417
HEINRICH ARN, HANS-RUDOLF BUSER, STEFAN RAUSCHER, and PATRICK M. GUERIN	
Allelopathic Research of Subtropical Vegetation in Taiwan: III. Allelopathic Exclusion of Understory by <i>Leucaena leucocephala</i> (Lam.) de Wit	1431
CHANG-HUNG CHOU and YAW-LUN KUO	
Isolation and Characterization of Glucocapparin in <i>Isomeris arborea</i> Nutt	1449
MATTHEW J. BLUA and ZAC HANSCOM, III	
<i>Euphydryas anicia</i> (Lepidoptera: Nymphalidae) Utilization of Iridoid Glycosides from <i>Castilleja</i> and <i>Besseyia</i> (Scrophulariaceae) Host Plants	1459
FRANK R. STERMITZ, DALE R. GARDNER, FRANCOIS J. ODENDAAL, and PAUL R. EHRLICH	
Potentially Defensive Proteins in Mature Seeds of 59 Species of Tropical Leguminosae	1469
DANIEL H. JANZEN, CLARENCE A. RYAN, IRVINE E. LIENER, and G. PEARCE	
Toxicities of Host Secondary Compounds to Eggs of Brassica Specialist <i>Dasineura brassicae</i>	1481
INGER ÅHMAN	
Identification of Sex Pheromone Produced by Female Sweetpotato Weevil, <i>Cylas formicarius elegantulus</i> (Summers)	1489
R.R. HEATH, J.A. COFFELT, P.E. SONNET, F.I. PROSHOLD, B. DUEBEN, and J.H. TUMLINSON	



Behavioral and Growth Responses of a Specialist Herbivore, <i>Homoeosoma electellum</i> , to Major Terpenoid of its Host, <i>Helianthus</i> Spp.	1505
MARYCAROL ROSSITER, JONATHAN GERSHENZON, and THOMAS J. MABRY	
Behavior of <i>Heliolithis virescens</i> (F.) in Presence of Oviposition Deterrents from Elderberry	1523
F.C. TINGLE and E.R. MITCHELL	
Allelopathic Influence of <i>Sorghum bicolor</i> on Weeds During Germination and Early Development of Seedlings	1533
OKSANA PANASIUK, DONALD D. BILLS, and GERALD R. LEATHER	
Study of Female Sex Pheromone of Leopard Moth, <i>Zeuzera pyrina</i> L.: Isolation and Identification of Three Components	1545
C. TONINI, G. CASSANI, P. MASSARDO, G. GUGLIELMETTI, and P.L. CASTELLARI	
Sex-Specific Activity of ( <i>R</i> )-(-)- and ( <i>S</i> )-(+)-1,7-Dioxaspiro [5.5]undecane, the Major Pheromone of <i>Dacus oleae</i>	1559
G. HANIOTAKIS, W. FRANCKE, K. MORI, H. REDLICH, and V. SCHURIG	

---

# Journal of Chemical Ecology

Volume 12, Number 7

July 1986

---

## CONTENTS

- Susceptibility to Vole Attacks Due to Bark Phenols and Terpenes in *Pinus contorta*  
Provenances Introduced Into Sweden 1569  
LENNART HANSSON, ROLF GREF, LENNART LUNDREN, and OLOF THEANDER
- Sex-Specific Production of Ipsdienol and Myrcenol by *Dendroctonus ponderosae*  
(Coleoptera: Scolytidae) Exposed to Myrcene Vapors 1579  
D.W.A. HUNT, J.H. BORDEN, H.D. PIERCE, JR., K.N. SLESSOR, G.G.S. KING, and  
E.K. CZYZEWSKA
- Interspecific Activity of Semiochemicals Among Sibling Species of *Pissodes* (Coleoptera:  
Curculionidae) 1587  
THOMAS W. PHILLIPS and GERALD N. LANIER
- Electroantennogram Responses by Mountain Pine Beetles, *Dendroctonus ponderosae*  
Hopkins, Exposed to Selected Semiochemicals 1603  
ARMAND T. WHITEHEAD
- Pheromone-Mediated Copulatory Responses of the Screwworm Fly, *Cochliomyia*  
*hominivorax* 1623  
L. HAMMACK
-

# Journal of Chemical Ecology

Volume 12, Number 8

August 1986

---

## CONTENTS

### Special Issue: Chemical Communication and Regulation of Sexual Reproduction, Growth, and Maturation of Schistosomes

Guest Editor: Everett L. Schiller

EDITORS' NOTE	1633
FOREWORD	1635
EVERETT L. SCHILLER	
Nematode Reproductive and Ingestive Responses to Helminth and Host Chemical Stimuli	1641
LEON W. BONE	
Role of Chemical Substances from Fish Hosts in Hatching and Host-Finding in Monogeneans	1651
G. C. KEARN	
Chemical Communication in Hermaphroditic Digenetic Trematodes	1659
BERNARD FRIED	
Internal Chemical Communication Within Flatworms	1679
PAUL F. BASCH	
Schistosome Behavior In Vitro	1687
L. K. EVELAND and M. A. HASEEB	
Chemical Communication in Adult Schistosomes	1699
M. A. HASEEB and L. K. EVELAND	
Mating Preference in <i>Schistosoma mansoni</i>	1713
DJAMSHID SHIRAZIAN, JAMES E. CHILDS, JULIA T. HAWKINS, and EVERETT L. SCHILLER	
Extraction of Intersexual Chemoattractants from <i>Schistosoma mansoni</i>	1725
JAMES B. GLOER, JERROLD MEINWALD, DJAMSHID SHIRAZIAN, JAMES E. CHILDS, and EVERETT L. SCHILLER	
In Vitro Orientation of Male <i>Schistosoma mansoni</i> to Extracts Derived from Female Schistosomes	1729
JAMES E. CHILDS, DJAMSHID SHIRAZIAN, JAMES B. GLOER, and EVERETT L. SCHILLER	
Time-Lapse Video Tape Documentation of Chemical Orientation by <i>Schistosoma mansoni</i> In Vitro	1739
EVERETT L. SCHILLER, DJAMSHID SHIRAZIAN, and JAMES E. CHILDS	
Male-Stimulated Female Maturation in <i>Schistosoma</i> : A Review	1745
IRENE POPIEL	



Structural and Metabolic Changes in Female <i>Schistosoma mansoni</i> Following Male Stimulation DAVID A. ERASMUS	1755
Elemental Changes During Sexual Maturation in <i>Schistosoma mansoni</i> MICHAEL K. SHAW	1765
Influence of Mating on Surface Nutrient Exchange in Schistosomes EAIN M. CORNFORD	1777
Portal Serum Constituents: Possible Determinants for Anatomical Localization of <i>Schistosoma mansoni</i> During Maturation and Reproduction GEORGE Y. WU and CATHERINE H. WU	1797
Limitations to Schistosome Growth and Maturation in Nonpermissive Hosts DONATO CIOLI, LIVIA PICA-MATTOCCIA, and PAUL M. KNOPF	1805
Identification of Sex-Linked Antigens of <i>Schistosoma mansoni</i> by Immunoelectrophoresis and Immunoblotting J. P. ROTMANS, O. C. BOERMAN, and A. BURGERS	1817
Biology of Tegument Associated IgG-Fc and C3 Receptors in <i>Schistosoma mansoni</i> WALTER M. KEMP, RICK L. TARLETON, TIMOTHY B. MCGUINNESS, KATHLEEN R. RASMUSSEN, and DANA V. DEVINE	1833
Strategies to Determine the Molecular Basis of Chemical Communication by Trematodes EUGENE G. HAYUNGA and MARY P. SUMNER	1843
Fundamental Aspects and Potential Roles of Ecdysteroids in Schistosomes: An Update Overview PHILIPPE NIRDÉ, MAX L. DE REGGI, and ANDRÉ CAPRON	1863
Developmental Changes in Energy Metabolism of <i>Schistosoma mansoni</i> and Physiological Role of Oxygen in Maintaining Parasite Function DAVID P. THOMPSON and JAMES L. BENNETT	1885
Effects of Steroids and Steroid Synthesis Inhibitors on Fecundity of <i>Schistosoma mansoni</i> In Vitro DAN D. MORRISON, ELIZABETH A. VANDEWAA, and JAMES L. BENNETT	1901

---

# Journal of Chemical Ecology

Volume 12, Number 9

September 1986

---

## CONTENTS

Sex Pheromone of Fall Armyworm, <i>Spodoptera frugiperda</i> (J.E. Smith): Identification of Components Critical to Attraction in the Field	1909
J.H. TUMLINSON, E.R. MITCHELL, P.E.A. TEAL, R.R. HEATH, and L.J. MENGELKOCH	
Odor Mimetism? Key Substances in the <i>Ophrys lutea</i> - <i>Andrena</i> Pollination Relationship (Orchidaceae: Andrenidae)	1927
A.-K. BORG-KARLSON and J. TENGÖ	
Female-Produced Sexual Pheromone of <i>Sceliododes cordalis</i> (Lepidoptera: Pyralidae)	1943
J.R. CLEARWATER, R.A. GALBREATH, M.H. BENN, and H. YOUNG	
Nestmate Recognition Cues in Laboratory and Field Colonies of <i>Solenopsis invicta</i> Buren (Hymenoptera: Formicidae): Effect of Environment and Role of Cuticular Hydrocarbons	1965
MARTIN S. OBIN	
ERRATA	1977

---

# Journal of Chemical Ecology

Volume 12, Number 10

October 1986

---

## CONTENTS

- Dietary Effects of Phytoecdysones in the Leek-Moth, *Acrolepiopsis assectella* Zell.  
(Lepidoptera: Acrolepiidae) 1979  
CLAUDE ARNAULT and KAREL SLÁMA
- Food Search Behavior in Arctic charr, (*Salvelinus alpinus*) (L.), Induced by Food  
Extracts and Amino Acids 1987  
K.H. OLSÉN, L. KARLSSON, and A. HELANDER
- Flavanone Glycosides as Oviposition Stimulants in a Papilionid Butterfly, *Papilio  
protenor* 1999  
KEIICHI HONDA
- Dynamics of 6-Methoxybenzoxazolinone in Winter Wheat: Effects of Photoperiod and  
Temperature 2011  
WILLIAM W. EPSTEIN, CAROL N. ROWSEMITT, PATRICIA J. BERGER, and NORMAN C.  
NEGUS
- Variation of Some Secondary Metabolites in Juvenile Stages of Three Plant Species from  
Tropical Rain Forest 2021  
R. SILVIA DEL AMO, JOSÉ G. RAMÍREZ, and OFELIA ESPEJO
-



# Journal of Chemical Ecology

Volume 12, Number 11

November 1986

---

## CONTENTS

- Ultrastructure of Exocrine Prothoracic Gland of *Datana ministra* (Drury) (Lepidoptera: Notodontidae) and the Nature of Its Secretion 2039  
I. WEATHERSTON, J.A. MACDONALD, D. MILLER, G. RIERE, J.E. PERCY-CUNNINGHAM, and M.H. BENN
- Identification of the Sex Attractant Pheromone of the Southwestern Corn Borer *Diatraea grandiosella* Dyar 2051  
P.A. HEDIN, F.M. DAVIS, J.C. DICKENS, M.L. BURKS, T.G. BIRD, and A.E. KNUTSON
- Sex-Identifying Urine and Molt Signals in Lobster (*Homarus americanus*) 2065  
JELLE ATEMA and DIANE F. COWAN
- Correlation of Retention Times on Liquid Crystal Capillary Column with Reported Vapor Pressures and Half-Lives of Compounds Used in Pheromone Formulations 2081  
R. R. HEATH and J. H. TUMLINSON
- Persistence of Nonprotein Seed Amino Acid S-( $\beta$ -Carboxyethyl)-Cysteine in Young Leaves of *Calliandra rubescens*: Ecological Implications 2089  
JOHN T. ROMEO and LEE A. SWAIN
-

# Journal of Chemical Ecology

Volume 12, Number 12

December 1986

---

## CONTENTS

Demonstration of an Odorous Intramale Primer Effect in Short-Tailed Vole, <i>Microtus agrestis</i> L. TASNEEM Y. KHAN and D. MICHAEL STODDART	2097
<i>Sabulodes caberata</i> Guenée (Lepidoptera: Geometridae): Components of Its Sex Pheromone Gland L.M. McDONOUGH, J.B. BAILEY, M.P. HOFFMANN, B.A. LEONHARDT, D.F. BROWN, C.L. SMITHISLER, and K. OLSEN	2107
Pinosylvin and Pinosylvin Methyl Ether as Feeding Deterrents in Green Alder THOMAS P. CLAUSEN, PAUL B. REICHARDT, and JOHN P. BRYANT	2117
Prediction of Release Ratios of Multicomponent Pheromones from Rubber Septa R.R. HEATH, P.E.A. TEAL, J.H. TUMLINSON, and L.J. MENGELKOCH	2133
AUTHOR INDEX TO VOLUME 12	2145
KEYWORD INDEX TO VOLUME 12	2151

---

